

Digeneans and acanthocephalans of birds from Formosa Province, Argentina

L. I. LUNASCHI, F. B. DRAGO, R. DRAGHI

Laboratorio de Helminología, División Zoología Invertebrados, Museo de La Plata, Paseo del Bosque S/N° 1900 La Plata, Buenos Aires, Argentina, E-mail: lunaschi@fcnym.unlp.edu.ar

Summary

The aim of this paper is to increase the knowledge on the diversity of digenean parasites from birds collected in northeastern Argentina. The helminthological survey of four bird species revealed the presence of five digenean species and one acanthocephalan species. The digeneans, *Lyperorchis lyperorchis* Travassos, 1921 and *Edietziana serrata* (Diesing, 1850) from *Aramus guarauna* (L.); *Nephrostomum limai* Travassos, 1922 from *Syrigma sibilatrix* (Temminck); *Athesmia heterolecithodes* (Braun, 1899) from *Theristicus caudatus* (Boddaert) and *Cariama cristata* (L.); *Stomylotrema vicarium* Braun, 1901 from *T. caudatus*, and the acanthocephala *Centrorhynchus guira* Lunaschi & Drago, 2010 from *T. caudatus*, were recorded. *Lyperorchis inexpectabilis* Digiani, 1997 is synonymized with *L. lyperorchis*. The findings of *E. serrata* and *N. limai* constitute new geographical records. *Theristicus caudatus* is reported as a new definitive host of *A. heterolecithodes*, *S. vicarium* and *C. guira*, and *Cariama cristata* of *A. heterolecithodes*. The relationships between host diet and parasite fauna are discussed.

Keywords: *Lyperorchis lyperorchis*; *Edietziana serrata*; *Nephrostomum limai*; *Athesmia heterolecithodes*; *Stomylotrema vicarium*; *Centrorhynchus guira*

Introduction

In the course of a parasitological survey carried out on birds from Formosa province, Argentina, were analyzed the helminths found in the Buff-necked Ibis, *Theristicus caudatus* (Boddaert) (Pelecaniformes, Threskiornithidae), in the Whistling Heron, *Syrigma sibilatrix* (Temminck), (Pelecaniformes, Ardeidae), in the Limpkin, *Aramus guarauna* (L.), (Gruiformes, Aramidae), and the Red-legged Seriema, *Cariama cristata* (L.) (Cariamiformes, Cariamidae). *Theristicus caudatus*, *S. sibilatrix* and *C. cristata* are exclusively Neotropical birds, and *A. guarauna* reaches also the Nearctic Region, in the states of Florida and Georgia. In spite of their wide geographical distribution, the most part of parasitological studies in these bird species were carried out in Brazil (see Table 1). Particularly in Argentina, three of them were reported as definitive hosts of digeneans: *T. caudatus* from La Plata Zoological Garden, Buenos Aires Province, was found parasitized by *Patagifer consimilis* Dietz, 1909 (Echinostomatidae); *A. guarauna* from Buenos Aires Province by *Lyperorchis inexpectabilis* Digiani, 1997 (Echinostomatidae) and *C. cristata* from Formosa Province by *Strigea inflecta* Lunaschi & Drago, 2012 (Strigeidae)

and *Brachylaima yupanquii* Freitas, Kohn & Ibáñez, 1967 (Brachylaimidae) (Boero & Led, 1968; Digiani, 1997; Lunaschi & Drago, 2012).

The aim of this paper is to increase the knowledge on the diversity of helminths parasites of birds from northeastern Argentina.

Materials and Methods

Eight birds, *C. cristata* (n=2); *A. guarauna* (n=1); *S. sibilatrix* (n=4) and *T. caudatus* (n=1), were shot between 2009 and 2012 in La Marcela farm (26°17'35"S; 59°08'38"W), Pirané, Formosa Province, Argentina, with the authorization of Ministerio de la Producción, Dirección de Fauna y Parques of Formosa Province. These species are considered as residents in the study area, with records for all months of the year, and evaluated as Least Concern (LC) by the International Union for Conservation of Nature (IUCN) (Di Giacomo, 2005). The birds were dissected in the field and the gastrointestinal tract was immediately examined. The digeneans were removed, and live adults were comprised and fixed in 5 % hot formalin, stored in 70 % ethanol, stained with a 1:6 dilution in 96 % ethanol of hydrochloric carmine, dehydrated

Table 1. Check-list of helminths reported in the Limpkin, Buff-necked Ibis, Red-legged Seriema and Whistling Heron in Neotropical Region

Hosts	Parasitic species	Country	Source
<i>Aramus guarauna</i>	Digenea		
	<i>Lyperorchis lyperorchis</i>	Brazil	Travassos (1921, 1922, 1928); Viana (1924)
		USA	Conti <i>et al.</i> (1985)
		Argentina	Digiani (1997), present study
	<i>Edietziana serrata</i>	Brazil	Dietz (1910); Travassos (1922); Travassos <i>et al.</i> (1969)
		Venezuela	Lutz (1928); Caballero & Díaz-Ungria (1958); Nasir & Díaz (1972)
		Cuba	Pérez Vigueras (1944, 1956)
		USA	Conti <i>et al.</i> (1985)
	<i>Lyperosomum sinuosum</i>	Brazil	Noronha <i>et al.</i> (2009)
	<i>Echinostomatidae</i>	USA	Conti <i>et al.</i> (1985)
	Nematoda		
	<i>Amidostomum acutum</i>	USA	Conti <i>et al.</i> (1985)
	<i>Strongyloides</i> sp.	USA	Conti <i>et al.</i> (1985)
	<i>Syncuaria calcarata</i>	Brazil	Yamaguti (1961)
	Cestoda		
	<i>Chimaerula wodlandi</i>	Brazil	Georgiev & Vaucher (2000)
<i>Theristicus caudatus</i>	Digenea		
	<i>Strigea vaginata</i>	Colombia	Dubois (1981)
	<i>Strigea bulbosa</i>	Brazil	Travassos <i>et al.</i> (1969)
	<i>Patagifer consimilis</i>	Argentina	Boero & Led (1968)
		Brazil	Travassos <i>et al.</i> (1969)
	<i>Echinostoma necopinum</i>	Brazil	Travassos <i>et al.</i> (1969)
	<i>Stomylotrema</i> sp.	Brazil	Travassos & Freitas (1940); Travassos <i>et al.</i> (1969)
	Nematoda		
	<i>Tetrameres (T.) spiroscopiculum</i>	Brazil	Magalhaes Pinto & Vicente (1995)
	<i>Capillaria</i> sp.	Brazil	Vicente <i>et al.</i> (1995a)
<i>Cariama cristata</i>	<i>Porrocaecum heteropterum</i>	Brazil	Digiani & Sutton (2001)
	Digenea		
	<i>Strigea inflecta</i>	Argentina	Lunaschi & Drago (2012)
	<i>Strigea vaginata</i>	Brazil	Travassos <i>et al.</i> (1969)
	<i>Brachylaima yupanquii</i>	Argentina	Lunaschi & Drago (2012)
	<i>Athesmia heterolecithodes</i>	Brazil	Travassos <i>et al.</i> (1969)
	Nematoda		
	<i>Ascaridia pterophora</i>	Brazil	Freitas & Ibáñez (1965); Cristofaro & Feijo (1976)
	<i>Subulura allodapa</i>	Brazil	Barreto (1919); Cristofaro & Feijo (1976)
	<i>Oxyspirura brevipenis</i>	Brazil	Ransom (1904)
<i>Syrigma sibilatrix</i>	<i>Oxyspirura altensis</i>	Brazil	Vicente <i>et al.</i> (1995b)
	Acanthocephala		
	<i>Oligacanthorhynchus taenioides</i>	Brazil	Travassos (1917)
	Cestoda		
	<i>Idiogenes horridus</i>	Brazil	Fuhrmann (1908); Schultz (1939)
	<i>Davainea brachyrhyncha</i>	Brazil	Fuhrmann (1908)
	Digenea		
	<i>Nephrostomum limai</i>	Brazil	Travassos <i>et al.</i> (1969)
	<i>Amphimerus interruptus</i>	Brazil	Arruda <i>et al.</i> (2001)
	<i>Stomylotrema graciosus</i>	Brazil	Arruda <i>et al.</i> (2001)
	Nematoda		
	<i>Tetrameres</i> sp.	Brazil	Vicente <i>et al.</i> (1995a)
	<i>Viktorocara</i> sp.	Brazil	Vicente <i>et al.</i> (1995a)
	<i>Cheilospirura hamulosa</i>	Brazil	Arruda <i>et al.</i> (2001)
	<i>Pelecitus</i> sp.	Brazil	Arruda <i>et al.</i> (2001)

and mounted in Canada balsam. The acanthocephalans were collected alive, extended in distilled water prior to fixation, fixed in 5 % formaldehyde, preserved in 70 % ethanol, cleared in Amman's lactophenol and studied under a light microscope. Both techniques used are described in Langeron (1942). Unless otherwise stated, measurements are given in micrometers (μm); the range is followed by the mean in parentheses. Drawings were made with the aid of a drawing tube. In the description of specimens the forebody is defined as the distance from the anterior end of body to the anterior border of the ventral sucker, and the hindbody from the posterior border of the ventral sucker to the posterior end of the body. The helminths were deposited at the Helminthological collection of the Museo de La Plata (MLP-He), and the birds were deposited at the Ornithological collection of the Museo de La Plata (MLP), La Plata, Argentina. Four paratypes MLP-He 3323/2 of *L. inexpectabilis* from *A. guarauna* were examined. The taxonomy of birds is given in accordance to Remsen *et al.* (2014).

Results

Trematoda

Family Echinostomatidae Looss, 1899

Subfamily Echinostomatinae Looss, 1899

Genus *Lyperorchis* Travassos, 1921

Lyperorchis lyperorchis Travassos, 1921 (Fig. 1)

Syn. *Lyperorchis inexpectabilis* Digiani, 1997

Description. (Based on 5 whole-mounted mature specimens) Body large, elongate and slender, with maximum width at level of testes. Forebody notably short, 8 – 13 % (11 %) of body length. Tegumental spines absent. Head collar indistinct, collar-spines not observed. Oral sucker subterminal, subglobular, smaller than ventral sucker. Ventral sucker muscular, spherical, in first third of body. Prepharynx absent. Pharynx muscular, transversely-oval, slightly smaller than oral sucker. Oesophagus long, sinuous. Intestinal bifurcation anterior to ventral sucker, at 6 – 10 % (8 %) of body length. Caeca long, reach to posterior extremity.

Testes 2, in tandem, tubular, contiguous or slightly overlapping one another. Post-testicular field short, 14 – 17 % (16 %) of body length. Cirrus-sac oval, between intestinal bifurcation and anterior margin of ventral sucker. Internal seminal vesicle large, tubular and coiled. Pars prostatica short. Everted cirrus not observed, apparently short. Genital pore median, posterior to intestinal bifurcation and located in a papillae-like elevation.

Ovary median, pretesticular, oval, separated from anterior testis by the ovary complex, at 48 – 56 % (53 %) of body length. Laurer's canal short, surrounded by numerous cells, with a possible glandular origin. Mehlis' gland conspicuous, median, posterior to ovary. Metraterm similar in length to cirrus sac. Uterus long, intercaecal, greatly convoluted, filling pre-ovarian region up to the posterior margin of ventral sucker; uterine seminal receptacle conspicuous. Eggs numerous, small, with inconspicuous operculum, 76 – 93 x 34 – 53 (84 – 43). Vitelline follicles small, in 2 lateral extra-caecal fields extending from post-acetabular region to posterior extremity, interrupted between ovary and anterior testis, and non-confluent in post-testicular region.

Excretory vesicle Y-shaped, with a long and chambered central stem, bifurcating posterior to the testes; excretory pore terminal.

Taxonomic summary

Host: *Aramus guarauna* (L.) (Syns. *A. scolipoceus*, *A. scolopaceus*) (Gruiformes, Aramididae) (Carau or Limpkin).

Infection site: cloaca.

Intensity of infection: 5.

Voucher material: MLP-He 6603.

Comments: *Lyperorchis lyperorchis* was described and reported parasitizing the recto and/or cloaca of Limpkin from Brazil and USA, and the Whooping crane, *Grus americana* L. (Gruiformes, Gruidae), from USA (Travassos, 1921, 1922, 1928; Conti *et al.*, 1985; Spalding *et al.*, 1996). The specimens here studied are in full agreement with those described by Travassos (1921), except the cirrus-sac length (740 – 870 vs. 474 – 580) (see Table 2).

On the other hand, we examined the specimens of *L. inexpectabilis* (4 paratypes) collected by Digiani (1997) from the cloaca of a Limpkin from Buenos Aires Province, Argentina. Three of these specimens were immature and one had only thirteen eggs. The holotype was not available, and its measures were calculated from the published drawing. Their body length, testes length, and eggs were similar in size to the specimens described herein. The most important differences are given in the body width, size of suckers, ovary and pharynx, but the majority of the calculated proportions are coincident (Fo, Ov, T, Ae-Ov, Pt, Os/Ph and Vs/Os) (see Table 2).

Moreover, the main diagnostic feature given by Digiani (op. cit.) to differentiate *L. inexpectabilis* from *L. lyperorchis* is the shape of testes, described as non-winding. However, the re-examination of the specimens of *L. inexpectabilis* leads us to conclude that the testicles are slightly sinuous, and due to its incomplete development, they have not reached the width that characterizes these organs in *L. lyperorchis*. This observation reveals that *L. inexpectabilis* should be considered synonymous with *L. lyperorchis*, and therefore, the geographical distribution of the species should be enlarged to Buenos Aires Province.

Genus *Edietziana* Özdikmen, 2013

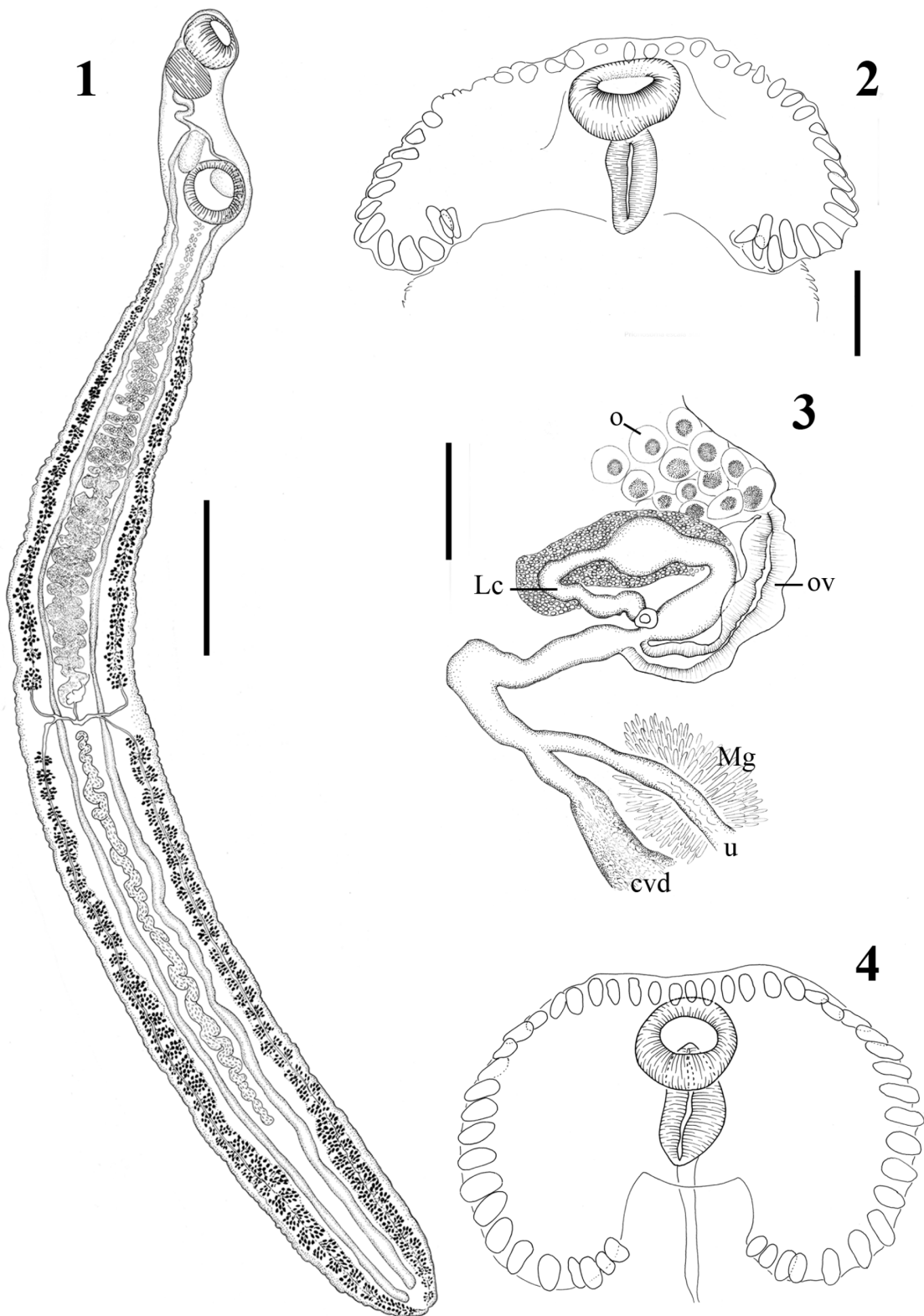
Syn. *Prionosoma* Dietz, 1909

Edietziana serrata (Diesing, 1850) Özdikmen, 2013 (Figs. 2 – 3)

Syn. *Prionosoma serratum* (Diesing, 1850) Dietz, 1909

Description. (Based on 1 whole-mounted mature specimen) Body large, elongate, linguiform, with maximum width at level of testes, 19 % of body length. Forebody notably short, 11 % of body length. Lateral margins of hindbody pleated. Tegument armed with spines in postacetabular region. Head collar relatively small, armed with 45 spines [(4)+7+9+7+(4)], rod-shaped, short, straight; angle spines markedly larger than lateral spines, dorsal spines in double row and lateral spines, apparently, in single row. Oral sucker subterminal, smaller than ventral sucker. Ventral sucker muscular, cup-shaped, with shallow cavity, in first fifth of body. Prepharynx not seen; pharynx muscular, longitudinally oval; oesophagus long. Intestinal bifurcation anterior to ventral sucker, at 8.3 % of body length; caeca long, reach to posterior end of body.

Testes 2, in tandem, tubular, thin, undulating. Post-testicular field short, 19 % of body length. Cirrus-sac oval, between intestinal bifurcation and anterior margin of ventral sucker. Internal seminal vesicle large and coiled. Pars prostatica and cirrus not observed.



Figs. 1 – 4. Echinostomatids from *Aramus guarauna* and *Syrigma sibilatrix* from northeastern Argentina
 Fig. 1. *Lyperorchis lyperorchis*. Entire worm, ventral view. Scale bar = 2mm. Figs. 2–3. *Edietziana serrata*. 2. Head-collar. Scale bar = 500 μ m. 3. Ovarian complex, dorsal view. Scale bar = 50 μ m. Fig. 4. *Nephrostomum limai*. Head-collar. Scale bar = 200 μ m. Abbreviations: cvd: common vitelline duct; Lc: Laurer's canal; Mg: Melhis' gland; o: ovary; ov: oviduct; u: uterus.

Table 2. Comparative data for *Lyperororchis lyperororchis* Travassos, 1921 and *Lyperororchis inexpectabilis* Digiani, 1997

Species	<i>Lyperororchis lyperororchis</i>				<i>Lyperororchis inexpectabilis</i>			
	Brazil		Argentina		Argentina			
Distribution								
Localities	Angra dos Reis, Matto Grosso	Formosa Province	Buenos Aires Province					
Source	Travassos (1921)	Present study	Digiani (1997)	Present study (Holotype*)	Present study (4 Paratypes)			
Body length	15 – 19 mm	17 – 22.5 mm (19 mm)	16.4 – 17.5 mm (17 mm)	17 mm	15.7 – 16.7 mm (16.1 mm)			
Body width	2 – 2.5 mm	1.4 – 2 mm (1.8 mm)	0.67 – 0.97 mm (0.76 mm)	0.98 mm	0.5 – 0.7 mm (0.6 mm)			
Forebody	-----	1.8 – 2.4 mm (2 mm)	-----	-----	1.2 – 1.4 mm (1.3 mm)			
Oral sucker length	550 – 780	503 – 629 (557)	240 – 300 (290)	320	242 – 290 (271)			
Oral sucker width		706 – 793 (756)	350 – 500 (430)	548	338 – 469 (413)			
Ventral sucker length		735 – 919 (834)	580 – 690 (630)	700	571 – 619 (595)			
Ventral sucker width	860 – 1000 Ø	783 – 870 (830)	570 – 630 (600)	644	484 – 619 (549)			
Pharynx length	480 – 670	483 – 629 (561)	240 – 350 (310)	311	266 – 338 (297)			
Pharynx width		600 – 774 (652)	240 – 420 (340)	388	237 – 362 (313)			
Oesophagus	780 – 870	551 – 850 (689)	490 – 660 (570)	455	484 – 532 (508)			
Ovary length	260 – 380 Ø	304 – 387 (365)	150 – 260 (200)	-----	155 – 204 (179)			
Ovary width		174 – 290 (219)	70 – 160 (110)	-----	62 – 106 (85)			
Anterior testis length	1300 – 2000	2057 – 3657 (2606)	1690 – 2050 (1880)	1679	1600 – 1857 (1786)			
Anterior testis width	-----	145 – 174 (162)	50 – 110 (80)	104	48 – 68 (58)			
Posterior testis length	1900 – 2400	2000 – 3571 (2671)	1690 – 2110 (2010)	1912	1686 – 2000 (1900)			
Posterior testis width	-----	126 – 179 (162)	40 – 100 (70)	106	48 – 68 (68)			
Cirrus-sac length	740 – 870	474 – 580 (524)	260 – 380 (320)	290	238 – 377 (302)			
Cirrus-sac width	-----	261 – 309 (276)	120 – 190 (116)	126	97 – 174 (129)			
Egg-length	85 – 134	76 – 93 (84)	87 – 101	-----	77			
Egg-width	42 – 49	34 – 53 (43)	41 – 48	-----	41			
Ae-Ov	-----	8.6 – 11.4 (9.9)	-----	-----	7.7 – 9.2 (8.4)			
Ae-Vv	-----	1.8 – 2.4 (2.2)	-----	1.3	1.2 – 1.4 (1.3)			
Pt	-----	3 mm	-----	3 mm	3 – 4 mm			
BW (%)	-----	6 – 11 (9)	4.1 – 5.5**	5.8	3 – 4.5 (3.7)			
Fo (%)	-----	8 – 13 (11)	-----	-----	7 – 9 (8)			
Ov (%)	-----	1.7 – 2.2 (1.9)	0.9 – 1.5**	-----	1 – 1.3 (1.1)			
T (%)	-----	14 – 17 (16)	-----	18	16 – 23 (19)			
Os/Ph	0.9**	0.8 – 1 (0.9)	0.7 – 1.6**	0.6	0.7 – 0.8 (0.75)			
Vs/Os	0.6 – 0.8**	0.86 – 0.94 (0.91)	0.6 – 0.8**	0.9	0.6 – 0.9 (0.8)			

* Measurements calculated from the published drawing; ** Calculated from original descriptions. Abbreviations (used also in Table 2): BW (%) – maximum body-width proportion to body-length; Fo (%) – forebody proportion to body-length; Ov (%) – ovary proportion to body-length; T (%) – post-testicular field proportion to body-length; Ae-Ov – distance from anterior extremity to ovary; Ae-Vv – distance from anterior extremity to ventral sucker; Pt – post-testicular region; Os/Ph: ratio oral sucker width/pharynx width; Vs/Os – sucker width ratio

Genital pore median, posterior to intestinal bifurcation.

Ovary median, slightly post-equatorial, oval, separated from anterior testis by the ovary complex, at 54 % of body length. Laurer's canal short. Mehlis' gland median, posterior to ovary. Metraterm not observed. Uterus long, greatly convoluted, inter-caecal, filling pre-ovarian region of body up to the posterior margin of ventral sucker. Eggs numerous, small, 101 x 48. Vitelline follicles small, in 2 lateral fields, extending from immediately postacetabular region to the posterior end of body, and non-confluent in post-testicular region. Excretory vesicle not observed; excretory pore terminal.

Taxonomic summary

Host: *Aramus guarauna* (L.) (Gruiformes, Aramidae).

Infection site: small intestine.

Intensity of infection: 1.

Voucher material: MLP-He 6604.

Comments: Özdikmen (2013) proposed the name *Edietziana* for *Prionosoma* Dietz, 1909 because this generic name was pre-occupied by a genus of hemipteran insects, and formulated new combinations for all species: *Edietziana malacophilum* (Pérez Vigueras, 1944), *Edietziana pricei* (Pérez Vigueras, 1944), *Edietziana serrata* (Diesing, 1850) (type species) and *Edietziana zachvatkini* (Sergienko, 1970).

In this paper we follow the taxonomy proposed by Kostadinova (2005), and consider valid the four species mentioned by Özdikmen. These species were found parasitizing the small intestine or cloaca of charadriiform, falconiform, gruiform, and pelecaniform birds from the Neotropical, Holarctic and Oriental Regions. At present, the only species reported in the Palaearctic region is *E. zachvatkini*. This species was described with 45 – 47 spines in the collar head, and found parasitizing *Rallus aquaticus* L., *Porzana parva* (Scopoli) (Rallidae) and *Gallinago gallinago* (L.) (as *Capella g.*) (Scolopacidae) (Sergienko, 1970). Two other species are exclusively Neotropical, *E. malacophilum* described with 46 spines, parasitizing *Rostrhamus sociabilis levis* Friedmann (Accipitridae) from Cuba, and *E. pricei*, with an unknown number of spines in the collar head, found in *Jacana spinosa violacea* (Cory) (Jacanidae) from Cuba. *Edietziana serrata*, with 45 spines and a wider geographical distribution, was found in *A. guarauna* and *A. guarauna pictus* (Meyer) from Brazil, Venezuela, Cuba and Florida, *Accipiter bicolor pileatus* (Temminck) (Accipitridae) from Paraguay, and *Egretta garzetta* (L.) and *Egretta intermedia* (Wagler) (Ardeidae) from Taiwan (Travassos, 1922; Lutz, 1928; Caballero & Diaz-Ungria, 1958; Conti *et al.*, 1985; Masi Pallares & Benítez Usher, 1972; Nasir & Díaz, 1972; Noronha *et al.*, 2009; Pérez Vigueras, 1944, 1956; Su & Fei, 2000).

The specimens here described exhibit morphological and morphometric features similar to those described in *A. guarauna* from Brazil by Dietz (1910) and Travassos *et al.* (1969) (Table 3).

This finding represents the first record of the genus *Edietziana* in Argentina.

Subfamily Nephrostominae Mendheim, 1943

Genus *Nephrostomum* Dietz, 1909

Nephrostomum limai Travassos, 1922 (Fig. 4)

Description. (Based on 3 whole-mounted mature specimens)

Body elongate, 6.63 – 8.45 (7.45) in total length, with maximum width at mid-uterine level 1.6 – 1.73 (1.68). Forebody notably short, 670 – 770 (730), 9 – 11 % (10 %) of body length. Oral sucker subterminal, small, 135 – 179 x 184 – 188 (153 – 185) surrounded by a large head collar with a wide ventral notch and a shallow dorsal depression, 532 – 580 x 793 – 870 (551 x 828), armed with 48 circumoral spines in a single row. Angle spines 2 x 4, 50 – 74 x 26 – 48 (62 x 37) are similar in size to lateral spines, 52 – 81 x 21 – 29 (67 x 25); the spines on dorsal depression are smaller, 48 – 57 x 21 – 33 (52 x 27). Ventral sucker deep, bell-shaped, larger than oral sucker, 880 – 1064 x 338 – 1112 (981 x 807). Prepharynx short; pharynx elongate-oval, 217 – 242 x 116 – 145 (225 x 127); oesophagus long, 314 – 435 (362) in length; intestinal bifurcation anterior to genital pore; caeca nearly reaching posterior extremity.

Testes small, elongate, lobed, in third quarter of body, anterior testis 774 x 484, posterior testis 822 x 387. Post-testicular field long, 24 % of body length. Cirrus-sac oval, dorsal to ventral sucker, 435 x 72. Ovary transversely oval, smooth, median, equatorial, 362 x 435. Uterus long, with numerous intercaecal loops between ovary and ventral sucker. Vitelline follicles small, distributed laterally from the posterior margin of ventral sucker to posterior extremity. Excretory vesicle Y-shaped; excretory pore dorso-subterminal. Eggs 106 – 110 x 39 – 57 (108 x 50).

Taxonomic summary

Host: *Syrigma sibilatrix* (Temminck) (Whistling Heron) (Pelecaniformes, Ardeidae).

Infection site: intestine.

Prevalence and mean intensity: 50 % (2 of 4), 4.

Voucher material: MLP-He 6787.

Comments: *Nephrostomum limai* was found parasitizing *S. sibilatrix* from Brazil (Travassos, 1922, 1938). In Argentina, the parasite was found naturally parasitizing the intestine of *Bubulcus ibis* (L.) (Ardeidae) from Río Negro Province (Sutton *et al.*, 1982). The specimens here described exhibit morphological and morphometric features similar to those described for *S. sibilatrix* from Brazil by Travassos (1922), but smaller than those described later by Travassos (1938) and Sutton *et al.* (1982) (body 6.6 – 8.5 vs. 15, 10.5 – 12, respectively).

The finding of *N. limai* parasitizing *S. sibilatrix* from Formosa Province enlarges the geographical distribution of this parasite.

Family Dicrocoeliidae Looss, 1899

Subfamily Dicrocoeliinae Looss, 1899

Genus *Athesmia* Looss, 1899

Athesmia heterolecithodes (Braun, 1899) Looss, 1899

Taxonomic summary

Hosts: *Theristicus caudatus* (Boddaert) (Buff-necked Ibis) (Pelecaniformes, Threskiornithidae); *Cariama cristata* (L.) (Red-legged Seriema) (Cariamiformes, Cariamidae).

Infection site: liver bile ducts.

Prevalence and mean intensity in *C. cristata*: 50 % (1 of 2), 12

Intensity of infection in *T. caudatus*: 15.

Voucher material: *C. cristata* MLP-He 6788; *T. caudatus* MLP-He 6789.

Table 3. Comparative data for *Edietziana serrata* (Diesing, 1850) Özdikmen, 2013

Source	Dietz (1910)	Perez Viguera (1944, 1956)	Travassos <i>et al.</i> (1969)	Masi Pallarés & Usher (1972)	Present study
Distribution	Brazil	Cuba	Brazil	Paraguay	Argentina
Hosts	<i>A. guarauna</i>	<i>A. guarauna pictus</i>	<i>A. guarauna</i>	<i>Accipiter bicolor pileatus</i>	<i>A. guarauna</i>
Body length	23 – 38 mm	11 mm	23 – 38 mm	17 mm	26 mm
Body width	1.56 – 3.12 mm	3 mm	1.56 – 3.12 mm	1.49 mm	5 mm
Forebody	----	----	----	----	2.8 mm
Collar head length	1560 – 3120	----	----	----	1343
Collar head width		----	----	----	2580
Angle spines	190 – 292 x 50 – 116	----	----	----	193 – 260 x 73 – 90 (222 x 85)
Lateral spines					106 – 174 x 58 – 72 (134 x 63)
Dorsal spines	150 – 231 x 54 – 108	----	----	----	92 – 101 x 53 – 59 (97 x 55)
Oral sucker length				160	474
Oral sucker width	369 – 730 Ø	330 Ø	369 – 730 Ø	170	619
Ventral sucker length		1090		840	1886
Ventral sucker width	936 – 1875 Ø	1060	936 – 1875 Ø	730	2286
Pharynx length	616	320	616	160	580
Pharynx width	462	160	462	120	261
Oesophagus	740 – 1040	610	780 – 1040	750	967
Ovary length		420	----	----	725
Ovary width	520 – 560 Ø	280	----	----	677
Anterior testis length	1350 – 2600	1150 – 1190	----	----	2064
Anterior testis width	325 – 361	280	----	----	287
Posterior testis length	1350 – 2600	1150 – 1190	----	----	2150
Posterior testis width	325 – 361	280	----	----	287
Cirrus-sac length	460 – 650	----	----	----	629
Cirrus-sac width	277 – 430	----	----	----	484
Egg-length	91 – 109	87	109	----	101
Egg-width	54 – 61	54	61	----	48
Ae-Ov	----	----	----	----	14
Ae-Vv	----	----	----	----	2.8
BW (%)	6.8 – 8.2*	27.3*	6.8 – 8.2*	8.8*	19.2
Fo (%)	----	----	----	----	10.8
Ov (%)	1.5 – 2.3*	3.8*	1.5 – 2.3*	----	3
T (%)	----	----	----	----	19.2
Os/Ph	0.6 – 1.3*	0.5*	0.6 – 1.3*	----	0.4
Vs/Os	0.4*	0.3*	0.4*	0.2*	0.3

* Calculated from original descriptions. See Table 2 for abbreviations

Comments: *Athesmia heterolecithodes* is almost a cosmopolitan species, described from mammals (procyonids, myocastorids, canids, cebid, callitrichid and pitheciid monkeys, phyllostomid bats, among others) and a wide range of bird species (anseriforms, charadriiforms, cuculiforms, falconiforms, gruiforms, passeriforms, pelecaniforms, strigiforms and tinamiforms) (Ewing *et al.*, 1968; Travassos *et al.*, 1969; Hammond, 1972; Lamothe-Argumedo & Jaimes Cruz, 1982; Martínez, 1985; Martínez &

Binda, 1992; Tantalean *et al.*, 1990; Digiani, 2000; Lunaschi & Drago, 2007 a, b, 2009; Vieira *et al.*, 2008). In Argentina, *A. heterolecithodes* was found parasitizing the bile ducts of *Plegadis chihi* (Vieillot) (Threskiornithidae), *Jacana jacana jacana* (L.) (Jacanidae), *Vanellus chilensis cayannensis* (Gmelin) (Charadriidae), *Aramides ypecaha* (Vieillot) (Rallidae) and *Nothura maculosa* (Temminck) (Tinamidae) from Buenos Aires Province, *Milvago chimachima* (Vieillot) (Falconidae), *Rostrhamus sociabilis*

(Vieillot) (Accipitridae) and *Guira guira* (Gmelin) (Cuculidae) from Formosa Province.

The finding of *A. heterolecitodes* parasitizing *T. caudatus* and *C. cristata* represents two new host records.

Family Stomylotrematidae Poche, 1926

Genus *Stomylotrema* Looss, 1900

Stomylotrema vicarium Braun, 1901

Taxonomic summary

Host: *Theristicus caudatus* (Boddaert) (Buff-necked Ibis) (Pelecaniformes, Threskiornithidae).

Infection site: cloaca.

Intensity of infection: 2.

Voucher material: MLP-He 6790.

Comments: The adult forms of *S. vicarium* were found naturally parasitizing the intestine and cloaca of a wide range of host birds: *Theristicus caerulescens* (Vieillot) (Threskiornithidae), *Ciconia maguari* (Gmelin) and *Jabiru mycteria* (Lichtenstein) (Ciconiidae) from Brazil; *Egretta caerulea* (L.) (Ardeidae) and *Tachybaptus dominicus* (L.) (Podicipedidae) from Cuba, and *Larus dominicanus* Lichtenstein (Laridae), *Busarellus nigricollis* (Latham) and *Buteogallus meridionalis* (Latham) (Accipitridae) from Argentina (Braun, 1901; Travassos, 1922, 1928; Szidat, 1964; Travassos *et al.*, 1969; Macko *et al.*, 1999; Lunaschi & Drago, 2009). Also, *Vanellus chilensis* (Molina) (as *Belonopterus cayennensis*) (Charadriidae) and *Gallus gallus domesticus* (L.) (Phasianidae) were reported as experimental hosts by Ostrowski de Núñez (1978). On the other hand, Travassos & Freitas (1940) reported an undetermined species of *Stomylotrema* parasitizing *T. caudatus*. Consequently, *T. caudatus* represents a new host record for *S. vicarium*.

Acanthocephala

Family Centrorhynchidae Van Cleave, 1916

Genus *Centrorhynchus* Lühe, 1911

Centrorhynchus guira Lunaschi & Drago, 2010

Taxonomic summary

Host: *Theristicus caudatus* (Boddaert) (Buff-necked Ibis) (Pelecaniformes, Threskiornithidae).

Infection site: small intestine.

Intensity of infection: 34.

Voucher material: MLP-He 6791.

Comments: This species was recently described by Lunaschi & Drago (2010) parasitizing the American Striped Cuckoo, *G. guira* from the same locality. The morphology and measurements of specimens obtained from *T. caudatus* are within the range of variability stated for this species.

The finding of *C. guira* in *T. caudatus* represents a new host record.

Discussion

The diet of *T. caudatus* is mainly composed of arthropods (insects, spiders, centipedes), amphibians, small reptiles, and occa-

sionally small mammals, snails and other small invertebrates found in soft soils (Matheu & del Hoyo, 1992). Three parasitic species, *S. vicarium*, *C. guira* and *A. heterolecitodes* were recovered in this host bird. The first two species were found exclusively in this bird species, and the latter, also in *C. cristata*. The partial life cycle of *S. vicarium* in Argentina was elucidated from naturally encysted metacercariae found in the visceral cavity of larvae of *Megadytes glauca* Brullé, 1837 (Coleoptera, Dityscidae), and the adults were experimentally obtained from *V. chilensis* and *G. g. domesticus* (Ostrowski de Núñez, 1978). Moreover, this author believes that virgule-cercariae that emerged from *Pomacea canaliculata* (Lamarck) (as *Ampularia* c.) could correspond to the metacercariae found in the larvae of *M. glauca*. Digiani (2002) and Amato and Amato (2006) reported *Belostoma oxyurum* (Dufour), *Belostoma foveolatum* (Mayr) and *Belostoma dilatatum* (Dufour) (Hemiptera, Belostomatidae) from Argentina and Brazil, respectively, as natural second intermediate hosts of this species. *Theristicus caudatus* can acquire this digenean by ingesting aquatic arthropods infected with metacercariae. The life cycle of *C. guira*, is unknown, however *Centrorhynchus* spp. uses birds and mammals as definitive hosts, terrestrial isopods or insects as intermediate hosts, and amphibious, reptiles or insectivorous mammals as transport or paratenic hosts. In the Neotropical Region, Amato *et al.* (2003) reported cystacanths of *Centrorhynchus* from Brazil parasitizing terrestrial isopods, *Atlantoscia floridana* (van Name) (Crustacea, Isopoda) as first intermediate host. In contrast, cystacanths of *Centrorhynchus* in paratenic hosts have been reported in several occasions, such as cysts of *Centrorhynchus tumidulus* Rudolphi, 1919 in the body cavity of *Ameiva ameiva* (L.), *Tupinambis teguixin* L. (Squamata, Teiidae) and *Tropidurus torquatus* (Wied-Neuwied) (Squamata, Tropiduridae) from Brazil; cystacanths of *Centrorhynchus* sp. in *Atelopus bomolochus* Peters (Anura: Bufonidae) from Perú, in *T. teguixin* from Paraguay, in *Rhinella fernandezae* (Gallardo) (Anura, Bufonidae) from Brazil, in *Eupsophus calcaratus* (Günther) and *Eupsophus roseus* (Duméril & Bibron) (Anura, Leptodactylidae) from Chile, and *Leptodactylus diptyx* (Boettger), *Leptodactylus bufonius* Boulenger (Anura: Leptodactylidae), *Leptophis ahaetulla marginatus* (Cope) (Squamata, Colubridae) and cystacanths of *C. guira* in the Maned Wolf, *Chrysocyon brachyurus* Illiger (Carnivora, Canidae) from Argentina (Vizcaino, 1993; Torres & Puga, 1996; Puga & Torres, 1999; Amato *et al.*, 2003; Iannaccone, 2003; Lamas & Lunaschi, 2009; Ávila & Silva, 2010; dos Santos & Amato, 2010; Hamann *et al.*, 2012; Zaracho *et al.*, 2012; González *et al.*, 2013). Then, *T. caudatus* probably acquire infestations of adult acanthocephalan by consumption of amphibious or reptiles infected with cystacanths.

The complete life cycle of *A. heterolecitodes* is unknown, but as a representative of Dicrocoeliidae, it should fulfil its biological cycle with the participation of pulmonate snails as first intermediate host. The cercariae may encyst as metacercariae in the mollusc, or in several species of arthropods and lizards, which act as second intermediate hosts (Patten, 1952). *Theristicus caudatus* and *C. cristata* have similar feeding habits given that *C. cristata* also feeds on large insects (Orthoptera), snakes and lizards (Di Giacomo, 2005). Therefore, probably both bird species can acquire *A. heterolecitodes* by eating insects and small reptiles, which act as potential intermediate hosts of this digenean species.

The diet of *A. guarauna* is mainly composed of apple snails, *Pomacea* spp. (Ampullariidae), and occasionally mussels, lizards, and variety of other small prey (Bryan, 1996). This host species was found parasitized by two echinostomatid species, *L. lyperorchis* and *E. serrata*, and so far, their life cycles have not been elucidated. The echinostomatids have mainly freshwater snails as first and second intermediate hosts and, to a lesser extent in tadpoles, fishes and annelids as second intermediate hosts. This allows us to suppose that *A. guarauna*, may become infested by ingesting metacercariae encysted in *P. canaliculata* and/or *Pomacea scalaris* (d'Orbigny), which are abundant in the study area. Finally, *S. sibilatrix* is almost exclusively insectivorous, with a preference for consumption of arthropods, especially insects such as grasshoppers, and can feed on small vertebrates as amphibians, lizards, and snakes (Franz *et al.*, 2007). This host was found parasitized by *N. limai* which, as the previously mentioned echinostomatids, have mainly freshwater snails as first and second intermediate hosts and, to a lesser extent, frog tadpoles, fishes and annelids as second intermediate hosts. In this context, Hamann *et al.* (2006, 2010) reported the occurrence of metacercariae of *Nephrostomum* sp. encysted in the liver of *Leptodactylus chaquensis* Cei (Anura, Leptodactylidae) and *Scinax nasicus* (Cope) (Anura, Hylidae) from Corrientes Province, Argentina. These frog species have been recorded in the El Bagual Ecological Reserve by Lavilla (2005), and therefore may have been the way of infection of *S. sibilatrix* with *N. limai*.

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